

## **CLOSURE INCLUDING CAP AND FITMENT HAVING GRIPPING MEMBER**

### **BACKGROUND OF THE INVENTION**

#### **Field of the Invention**

[001] This invention relates to a closure including a cap and a fitment having a new and improved grip for removing a frangible membrane.

#### **Description of Related Art**

[002] An exemplar of a conventional fitment is U.S. Patent No. 5,133,486 to Moore *et al.* which shows a tamper evident pull ring pour spout. Another conventional fitment is disclosed by U.S. Patent No. 5,301,849 to Guglielmini *et al.* which discloses a spout assembly and a sealing cap with a spring-loaded hinge. U.S. Patent No. 5,735,426 to Babcock *et al.* discloses a fitment-closure assembly for a gable-topped carton. U.S. Patent No. 5,765,747 to Lawson discloses a pour spout fitment for a gable top container.

[003] Other fitments having frangible membranes are disclosed by U.S. Patent Nos. 6,129,228, 5,957,312 and 5,915,574, all to Adams *et al.*, each of which discloses one or more fitments having a removable membrane.

[004] The fitments disclosed by the above patents include pull rings which are generally small rings located entirely within the spout of the fitment. The configuration and position of such pull rings may render it difficult for a user to grasp the pull ring and remove the removable membrane from the fitment.

[005] What is needed is a new and improved cap and fitment which overcomes the above and other disadvantages of known closures.

## SUMMARY OF THE INVENTION

[006] In summary, one aspect of the present invention is directed to a fitment including a spout flange, a spout, a frangible membrane and a gripping member. The spout projects upward from the spout flange and has upper and lower ends and an inner wall. The frangible membrane seals off the spout and has a peripheral edge joined to the inner wall surface along a line of weakness. The gripping member is adapted to facilitate removal of the frangible membrane from the spout. The gripping member includes a semicircular member which has first and second terminal ends. The first end is connected to the frangible membrane adjacent the line of weakness, and the second end is remotely located from the first end. In one embodiment, the semicircular member has gripping protrusions extending radially inward from an inner wall thereof. In one embodiment, the semicircular member is helically shaped. In one embodiment, the second end of the semicircular member is located above the upper end of the spout. In one embodiment, the semicircular member extends approximately 270°.

[007] Another aspect of the present invention is directed to a fitment including a spout flange, a spout, a frangible membrane, and a gripping member. The spout projects upward from the spout flange and has upper and lower ends and an inner wall. The frangible membrane seals off the spout and has a peripheral edge joined to the inner wall surface along a line of weakness. The gripping member is adapted to facilitate removal of the frangible membrane from the spout. The gripping member includes a straight member and has first and second terminal ends. The first end is connected to the frangible membrane adjacent the line of weakness. The second end is remotely located from the first end. The gripping member is monolithically formed with the spout flange, spout and frangible membrane such that the straight segment extends at an acute angle with respect to the frangible membrane. In one embodiment, the straight member extends at an angle of

approximately 15° to approximately 45° with respect to the frangible membrane. In one embodiment, the straight member extends at an angle of approximately 30° with respect to the frangible membrane. In one embodiment the gripping member includes a rib extending substantially perpendicular from a surface of the straight segment adjacent the second terminal end.

[008] Another aspect of the present invention is directed to a fitment including a spout flange, a spout, a frangible membrane, and a gripping member. The spout projects upward from the spout flange and has upper and lower ends and an inner wall. The frangible membrane seals off the spout and has a peripheral edge joined to the inner wall surface along a line of weakness. The gripping member is adapted to facilitate removal of the frangible membrane from the spout and has a horizontally extending member that has first and second ends. The first end is connected to the frangible membrane adjacent the line of weakness. The second end is remotely located from the first end. A portion of the horizontally extending member is located above the upper end of the spout. In one embodiment, the fitment includes a frangible connector interconnecting a portion of the horizontally extending member and an adjacent portion of the frangible membrane, in which case, the frangible connector is located between the first and second ends. In one embodiment, the fitment includes at least two frangible connectors, in which case, each frangible connector interconnects a portion of the horizontally extending member and a respective portion of the frangible membrane.

[009] Yet another aspect of the present invention is directed to a fitment including a spout flange, a spout, a frangible membrane, a gripping member, and a frangible connector. The spout projects upward from the spout flange and has upper and lower ends and an inner wall. The frangible membrane seals off the spout and has a peripheral edge joined to the inner wall surface along a line of weakness. The gripping member is adapted to facilitate removal of the frangible membrane from the spout and includes a horizontally extending member that has first and second ends. The first end is connected to the frangible membrane adjacent the line of

weakness. The second end is remotely located from the first end. The frangible connector interconnects a portion of the horizontally extending member and an adjacent portion of the frangible membrane. The frangible connector is located between the first and second ends. In one embodiment, the fitment includes at least two frangible connectors, in which case, each frangible connector interconnects a portion of the horizontally extending member and a respective portion of the frangible membrane.

[010] Yet another aspect of the present invention is directed to a fitment including a spout flange, a spout, a frangible membrane, a gripping member and a frangible connection. The spout projects upward from the spout flange and has upper and lower ends and an inner wall. The frangible membrane seals off the spout and has a peripheral edge joined to the inner wall surface along a line of weakness. The gripping member is adapted to facilitate removal of the frangible membrane from the spout and includes a horizontally extending member which has a lower edge and a first end. The first end is connected to the frangible membrane adjacent the line of weakness. The frangible connection interconnects a portion of the lower edge of the horizontally extending member and an adjacent portion of the upper end of the spout. In one embodiment, the gripping member further includes a second terminal end which is remotely located from the first end. In one embodiment, the horizontally extending member extends at least approximately 270° along the upper end of the spout. In one embodiment, the horizontally extending member includes a lower tapered edge which terminates at the frangible connection. In one embodiment, a web interconnects the gripping member and the frangible membrane adjacent the line of weakness. In one embodiment, the fitment further includes a stop which is adapted to limit propagation along the frangible connection. The stop interrupts the frangible connection adjacent the first end of the horizontally extending member. In one embodiment, the stop has an aperture in the frangible connection adjacent the first end of the horizontally extending member. In one embodiment, the horizontally extending member of the gripping member includes a

cap-engaging structure. Optionally, the cap-engaging structure includes an external thread which is adapted to cooperate with an internal thread of a cap.

[011] An object of the present invention is to provide a closure including a cap and a fitment having a new and improved gripping member in order to facilitate a user in initially opening the fitment of the closure.

[012] The closure of the present invention has other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated in and form a part of this specification, and the following Detailed Description of the Invention, which together serve to explain the principles of the present invention.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[013] FIG. 1 is a perspective view of a closure having fitment and a resealable cap in accordance with the present invention shown in combination with a container.

[014] FIG. 2 is an enlarged exploded perspective view of the fitment and cap shown in FIG. 1.

[015] FIG. 3 is a cross-sectional view of the fitment and cap shown in FIG. 1 taken along line 3-3 in FIG. 1.

[016] FIG. 4 is a perspective view of a fitment similar to that shown in FIG. 2 and having a modified gripping member in accordance with the present invention.

[017] FIG. 5 is another perspective view of the fitment of FIG. 5.

[018] FIG. 6 is a top view of the fitment of FIG. 5.

[019] FIG. 7 is a cross-sectional view of the fitment of FIG. 5 taken along line 7-7 of FIG. 6.

[020] FIG. 8 is a cross-sectional view of the fitment of FIG. 5 taken along line 8-8 of FIG. 6.

[021] FIG. 9 is a top view of a fitment similar to those shown in FIGS. 2 and 5 and having a modified gripping member in accordance with the present invention.

[022] FIG. 10 is a cross-sectional view of the fitment of FIG. 9 taken along line 10-10 of FIG. 9.

[023] FIG. 11 is a cross-sectional view of the fitment of FIG. 9 taken along line 11-11 of FIG. 9.

[024] FIG. 12 is a perspective view of a fitment similar to those shown above and having a modified gripping member in accordance with the present invention.

[025] FIG. 13 is a cross-sectional view of the fitment of FIG. 12 taken along line 13-13 of FIG. 12.

[026] FIG. 14 is a top view of a fitment similar to those shown above and having a modified gripping member, sealing flange and spud-engaging bead in accordance with the present invention.

[027] FIG. 15 is a cross-sectional view of the fitment of FIG. 14 taken along line 15-15 of FIG. 14.

[028] FIG. 16 is a cross-sectional view of the fitment of FIG. 14 in combination with a modified cap in accordance with the present invention.

[029] FIG. 17 is a perspective view of a fitment similar to those shown above and having a modified frangible membrane in accordance with the present invention.

[030] FIG. 18 is a cross-sectional view of the fitment of FIG. 17 taken along line 18-18 of FIG. 17 in combination with a modified cap in accordance with the present invention.

[031] FIG. 19 is a perspective view of a fitment similar to those shown above and having a modified sealing flange in accordance with the present invention.

[032] FIG. 20 is a cross-sectional view of the fitment of FIG. 19 taken along line 20-20 of FIG. 19 in combination with a modified cap in accordance with the present invention.

[033] FIG. 21 is a perspective view of a fitment similar to those shown above and having a modified spout, membrane and gripping member in accordance with the present invention.

[034] FIG. 22 is a cross-sectional view of the fitment of FIG. 21 taken along line 22-22 of FIG. 21 in combination with a modified cap in accordance with the present invention.

[035] FIG. 23 is a perspective view of a fitment similar to those shown above and having a modified spout, frangible membrane and gripping member in accordance with the present invention.

[036] FIG. 24 is a side view of the fitment of FIG. 23.

[037] FIG. 25 is a cross-sectional view of the fitment of FIG. 23 taken along line 25-25 of FIG. 24.

[038] FIG. 26 is an enlarged detail view of a portion of the fitment of FIG. 23 as shown in FIG. 25.

[039] FIG. 27 is an enlarged cross-sectional view of a portion of the fitment of FIG. 23 taken along line 27-27 of FIG. 23.

[040] FIG. 28 is an enlarged cross-sectional view of a portion of the fitment of FIG. 23 taken along line 28-28 of FIG. 23.

[041] FIG. 29 is a cross-sectional view, similar to FIG. 25, of the fitment of FIG. 23 shown in combination with a modified cap in accordance with the present invention.

[042] FIG. 30 is a cross-sectional view of the fitment and cap shown in FIG. 29 but having showing the frangible membrane and gripping member removed from the spout.

#### **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[043] Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to those embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims.

[044] Turning now to the drawings, wherein like components are designated by like reference numerals throughout the various figures, attention is directed to FIGS. 1-4 which show a closure 30 in accordance with the present invention mounted upon a container 31. Container 31 is a conventional paperboard carton of the type commonly used for distributing and dispensing beverages, including juice and milk.



[045] Closure 30 includes a fitment 32 and a removable and resealable cap 36. As shown in FIG. 2, fitment 32 is attached to container 31 in a known manner. Although the closure of the present invention is illustrated in combination with a paperboard carton, one should appreciate that closure of the present invention is equally suited for use with other types of containers including beverage bags, sacks, and other flexible packaging. Furthermore, the fitment described herein is equally suited for use with other types of containers and closures therefore.

[046] Suitable materials for the fitment of the present invention include, but are not limited to, low density polyethylene, linear low density polyethylene, high density polyethylene, polypropylene, and other suitable materials. Suitable materials for the cap of the present invention include, but are not limited to, low density polyethylene, high density polyethylene, polypropylene, polystyrene, and other suitable materials.

[047] Referring to FIG. 2, fitment 32 includes an annular spout flange 37 and a spout neck 38 extending upward therefrom. One should appreciate that the terms upward and downward as well as inward and outward are not intended to denote vertical or horizontal directions and are merely provided for clarity with reference to the drawings. Annular flange 37 is attached to container 31 adjacent a dispensing hole (not shown) thereof by ultrasonically welding, adhesives, or other suitable means. As shown in FIG. 3, neck 38 includes an opening defined by an inner wall 41 thereof that, together with the container dispensing hole, allows dispensing of the contents of container 31. Preferably, neck 38 also includes an external cap engaging structure in the form of external threads 42 provided on an upper portion of outer wall 43.

[048] Cap 36 includes a top 47 and an annular skirt 48 extending downward from from top 47 adjacent a periphery of the top, as shown in FIG. 3. Internal spout-engaging structure in the form of internal threads 49 extend inward from an inner wall 52 of skirt 48. Internal threads 49 cooperate with external threads 42 to

selectively disengage and reengage cap 36 with respect to spout 32. In particular, cap 36 is removed from spout 32 by twisting cap 36 in one direction relative to container 31 and unthreading cap 36 from spout 32. Cap 36 is reengaged with spout 32 by twisting the cap in the opposite direction relative to spout 32 and re-threading cap 36 onto spout 32. Thus, if the contents of the container are not completely dispensed, cap 36 may be used for reclosure purposes.

[049] The cooperating internal and external threads may be in the form of multi-lead threads or a single lead thread extending partially or completely around the outer neck wall of the spout. One should also appreciate that the threads may be either continuous or segmented. Alternatively, the external closure-engaging structure and the internal spout-engaging structure may take various other forms. For example, complementary interengaging snap beads, instead of complementary threads, can be located on the closure and the spout respectively to form the external closure-engaging structure and the internal spout-engaging structure for the purpose of selectively interengaging the closure and the spout.

[050] Preferably, cap 36 includes a hollow annular plug 53 depending downwardly from an inner surface of cap 36 adjacent the intersection of top 47 and skirt 48, as shown in FIG. 3. Although the illustrated embodiment shows annular plug 53 as extending from a portion of cap 36 adjacent the intersection of top 47 and skirt 48, one should appreciate that the annular plug can extend from either the top or the skirt in accordance with the present invention.

[051] Preferably, an interference fit between an outer surface of plug 53 and an upper portion of inner wall 41 provide a resealable primary seal for the contents of container 31. In the illustrated embodiment, the upper portion of neck 38 includes a sealing flange 54 which engages plug 53 in order to provide a fluid seal between fitment 32 and cap 36. In particular, neck 38 has a thin-walled portion which flares outwardly and inwardly to form sealing flange 54. Such a configuration of sealing flange 54 allows the sealing flange to “give” and distort to provide a tight

interference fit between sealing flange 54 and plug 53. In particular, sealing flange 54 has an outwardly tapered inner surface which is complementary to an inwardly tapered outer surface of plug 53. Cap 36 and fitment 32 are formed of materials that are flexible enough to allow the sealing flange 54 to stretch and to allow plug 53 to compress sufficiently to receive one another and provide a fluid tight seal therebetween.

[052] Advantageously, the complementary angled surfaces of flange seal 54 and plug 53, as well as the thinned wall thickness of flange seal 54, provide a configuration which provides a better interference and/or compression fit between flange seal 54 and plug 53 resulting in an improved fluid seal.

[053] One should appreciate that the plug may be provided in the form of a solid disk projecting from the inner surface of top 47 as well as other suitable forms. Alternatively, one should appreciate that a closure without a plug also falls within the scope of the present invention. In the event that the closure is not provided with a plug, a liner of compressible material may be provided to seal the inner surface of the closure against the sealing flange of the spout or, alternatively, the flange seal may compress directly against a lower surface of the cap top..

[054] With continued reference to FIGS. 2 and 3, spout 32 preferably includes a tamper-indicating frangible membrane 63 which seals the opening of spout 32 until a consumer initially opens the container. An outer periphery of membrane 63 is frangibly connected to an intermediate portion of inner wall 39 along a line of weakness 64 in a well known manner which allows a consumer to pull and tear membrane 63 from spout 32. One should appreciate that the tamper-indicating membrane may be located at a bottom edge of the spout or at any desired location above said bottom edge. In the illustrated embodiment, fitment 32 includes a spud-engaging structure in the form of a continuous spud-engaging bead 65. Spud-engaging bead 65 is provided to frictionally engage the exterior of a spud of automatic equipment which is generally used to apply a fitment to a container in a

manner similar to that disclosed by U.S. Patent Nos. 6,129,228, 5,957,312 and 5,915,574, all to Adams *et al.*, the entire contents of which patents are incorporated herein by this reference.

[085] Fitment 32 includes a gripping member 69 which is provided on frangible membrane 63 to allow a user to remove frangible membrane 63 from spout neck 38 in a well known manner. In accordance with present invention, gripping member 64 is specifically adapted to facilitate a user in gripping and pulling the gripping member when removing frangible membrane.

[086] As shown in FIG. 2, gripping member 64 includes a semicircular segment 70 which has first and second terminal ends. A first terminal end 71 is connected to frangible membrane 63 adjacent line of weakness 64. Second terminal end or free end 74 is remotely located from first terminal end 71. The second terminal end is a free end in that the second terminal end is not connected to the first terminal end, the frangible membrane nor any other structure of the fitment. Preferably, the gripping member is monolithically formed with the frangible membrane and the remaining portions of the fitment.

[087] A portion of gripping member 64 extends above an upper edge of spout neck 38a as shown in FIG. 3 in such a manner that it may facilitate a user in clenching or grasping the gripping member. In particular, a portion of semicircular segment 70 extends horizontally and slightly above the upper edge of sealing flange 54. Such positioning provides additional space below semicircular segment 70 and between segment 70 and frangible membrane 63. Such positioning may facilitate a user in inserting a fingertip below semicircular segment 70 thus facilitating a user in pulling and gripping member 64 as discussed in greater detail below.

[088] To further facilitate a user in clenching gripping member 63, second terminal end 74 is provided with several outwardly extending ribs 75. One should appreciate that one or more ribs may be used in accordance with present invention.

Alternatively, the gripping member may be free of such outwardly extending ribs. One should further appreciate, that the gripping member may be provided with a textured surface in order to facilitate a user in grasping or clenching the gripping member.

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[059] In the illustrated embodiment, gripping member 64 extends approximately 270° along an arcuate path which is substantially concentric with spout neck 38. Gripping member 64 extends in a space defined above frangible membrane 63 and within inner wall 41 of spout neck 38. One should appreciate that a semicircular segment 70 of gripping member 69 may extend along an arcuate path within the range of approximately 180° up to but slightly less than approximately 360°.

[060] In operation an use, a consumer will sometimes remove cap 36 from fitment 32 and verify that frangible membrane is intact in order to ensure that the contents of container 31 have not been tampered with. In order to initially open container 31, the user will again remove cap 36 from fitment 32, if necessary, to expose gripping member 69 located within spout neck 38. The user inserts a finger under semicircular segment 70 in such a manner that the user can bend or pry a portion of gripping member 64 upward from spout neck 38. Advantageously, gripping member 64 is flexible and allows the user to straighten semicircular segment 70 to some degree allowing the segment to better conform to the contour of the user's finger. As semicircular segment 70 has a flat profile, a user can securely grip semicircular segment 70 firmly between his or her index finger and thumb thus facilitating the removal of frangible membrane 63 from spout neck 38. Once frangible membrane 63 is removed, the user may then partially or wholly dispense the contents of container 31. In the event that a portion of the contents remains within the container, the user may then reseal the container by threading cap 36 back onto fitment 32.

[061] In some respects, parts of the closure of the present invention discussed above resemble those of the embodiments discussed below. Accordingly, like

reference numerals have been used to describe like components of the illustrated closures of the present invention.

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[062] In one embodiment shown in FIGS. 4-8, a modified fitment 32a includes a modified gripping member in accordance with the present invention. In many other respects, the structure of fitment 32a resembles that of fitment 32 discussed above. Fitment 32a includes an annular spout flange 37a and a spout neck 38a extending upwardly therefrom. Neck 38a has a thin-walled portion which flares outwardly and upwardly to form a sealing flange 54a. A tamper-indicating frangible membrane 63a seals the opening of fitment 32a in the same manner as discussed above.

[063] Fitment 32a also includes a spud-engaging structure in the form of discrete spud-engaging protrusions 76 which are substantially semicircular in shape. In the illustrated embodiment, fitment 32a includes eight spud-engaging protrusions 76, however, one should appreciate that one or more spud-engaging protrusions may be utilized in accordance with present invention.

[064] Fitment 32a includes a gripping member 69a having inwardly extending ribs 80 instead of the outwardly extending ribs described above. Ribs 80 are provided to improve a user's grip on member 69a. One should appreciate that the gripping member can include inwardly extending ribs in addition to outwardly extending ribs in accordance with the present invention. Gripping member 69a also includes a tapered bottom surface 81 which may further facilitate a user in gripping and pulling member 69a.

[065] The general structure and appearance of gripping member 69a is more rounded than that of gripping member 69 discussed above. The more rounded appearance has several advantages including, but not limited to, increased aesthetics and an improved de-molding shape.

[066] In one embodiment shown in FIGS. 9-11, a modified fitment 32*b* includes another modified gripping member in accordance with the present invention. As shown in FIGS. 10 and 11, gripping member 69*b* extends in a helical path extending upward and outward from spout neck 38*b*. Gripping member 69*b* is molded in its helical shape. Fitment 32*b* is formed of materials that are flexible enough to allow gripping member 69*b* to flex substantially. Thus, when fitment 32*b* is assembled with a cap, the flexibility of gripping member 69*b* allows it to flex downwardly and position itself within the space defined by an upper surface of frangible membrane 63*b*, inner wall 41*b* of spout neck 38*b*, and an inner surface of the top of the cap without damaging frangible membrane 63*b*.

[067] In one embodiment shown in FIGS. 12-13, a modified fitment 32*c* includes another modified gripping member in accordance with the present invention. As shown in FIGS. 12 and 13, gripping member 69*c* includes a straight segment 82 which extends at an arcuate angle with respect to frangible membrane 63*c*, namely, upwardly and outwardly from spout neck 38*c*. Gripping member 69*c* is molded in its straight shape at an angle of approximately 30° with respect to frangible membrane 63*c*. One should appreciate that gripping member 69*c* can extend from frangible membrane at an angle of approximately 10° to approximately 60°, and preferably at an angle of approximately 15° to approximately 45° in accordance with the present invention.

[068] Gripping member 69*c* includes a rib 85 which extends substantially perpendicular from both an upper surface and a lower surface of straight segment 82 adjacent the distal or second terminal end 74*c*. One should appreciate, however, that a rib can extend from one and/or the other of the upper and lower surfaces of the straight segment to facilitate gripping by a consumer in accordance with the present invention.

[069] Fitment 32*c* is formed of materials that are flexible enough to allow gripping member 69*c* to flex substantially. Thus, when fitment 32*c* is assembled with a cap,

the flexibility of gripping member 69c allows it to flex downwardly and position itself within the area defined by an upper surface of frangible membrane 63c, inner wall 41c of spout neck 38c, and an inner surface of the top of the cap without damaging frangible membrane 63c.

[070] In one embodiment shown in FIGS. 14-16, a modified fitment 32d includes another modified gripping member in the form of a gripping ring, a modified sealing flange, and spud-engaging projections in accordance with present invention. In many other respects, the structure of fitment 32d resembles that of the fitments discussed above.

[071] In contrast to the above fitments, fitment 32d includes a gripping ring 86 which is similar in some aspects to conventional pull rings found on prior fitments. Gripping ring 86 includes a circular portion 91 that extends within a substantially horizontal plane. Importantly and in contrast to prior conventional pull rings, a portion of gripping ring 86 extends above the top edge of spout neck 38d and sealing flange 54d. Such positioning of the gripping ring 86 makes it more accessible and provides additional space below the ring and between gripping ring 86 and frangible membrane 63d in a similar manner as the positioning of semicircular segment 70 discussed above. Accordingly, such positioning may facilitate a user in inserting a fingertip or a fingernail below gripping ring 86 thus facilitating pulling gripping ring up from the interior of spout neck 38d allowing the user to conveniently grasp gripping ring 86 and remove frangible membrane 63d.

[072] As shown in FIG. 15, sealing flange 54d includes a thin-wall section 92 that has a substantially uniform wall thickness that is significantly less than the wall thickness of spout neck 38d. Such configuration defines an upper annular sealing surface 93 on an upper portion of spout neck 38 which is disposed inwardly of thin-wall section 92 and substantially below an upper edge of thin-wall section 92.



[073] Cap 36*d* includes an annular plug flange 53*d* which extends inwardly and downwardly from an inner surface of skirt 48*d* adjacent top 47*d*. Plug flange 53*d* has a curved profile that is complementary to that of thin-wall section 92, as is shown in FIG. 16. Plug flange 53*d* and sealing flange 54*d* are dimensioned and configured to provide an interference therebetween when cap 36*d* is screwed onto and engaged with fitment 32*d*. Furthermore, a lower edge 96 of plug flange 53*d* is dimensioned and configured to abut against annular sealing surface 93 of spout neck 38*d* to provide and/or supplement a fluid-tight seal between cap 36*d* and fitment 32*d*.

[074] Cap 36*d* further includes a modified spud-engaging structure in the form of vertically extending spud-engaging splines 97 which extend radially inwardly from inner wall 41*d* of spout neck 38*d*. Spud-engaging splines 97 are provided to frictionally engage the exterior of the spud of automatic equipment in a manner similar to that discussed above.

[075] In one embodiment shown in FIGS. 17-18, a modified fitment 32*e* includes a modified frangible membrane in accordance with present invention. In many other respects, the structure of fitment 32*e* resembles that of the fitments discussed above.

[076] In contrast to the above embodiments, frangible membrane 63*e* has a convex shape, as shown in FIG. 18. A portion of gripping ring 86*e* horizontally extends above an upper edge of sealing flange 54*e* in a manner similar to that discussed above. Because frangible membrane 63*e* extends downwardly from gripping ring 86*e*, the space below gripping ring is further increased to further facilitate a user in inserting a fingertip below gripping ring 86*e* thus facilitating the user in gripping and pulling gripping ring 86*e*.

[077] In one embodiment shown in FIGS. 19-20, a modified fitment 32*f* includes another modified sealing flange in accordance with present invention. In many

other respects, the structure of fitment 32f resembles that of the fitments discussed above.

[078] Sealing flange 53f extends upwardly and outwardly from a upper portion of spout neck 38f in a similar manner as the sealing flanges of the above embodiments. In this embodiment, however, the only portion of sealing flange 53f that has a thinner wall thickness than that of the remaining portions of spout neck 38f is the portion which extends radially outward of outer wall 43f of spout neck 38f, as most clearly shown in FIG. 20. Hollow annular plug 53f has an increased wall thickness with respect to that of the above embodiments.

[079] In one embodiment shown in FIGS. 21-22, a modified fitment 32g includes a modified spout and cap, a modified frangible membrane and a modified gripping ring in accordance with present invention. In many other respects, the structure of fitment 32g resembles that of the fitments discussed above.

[080] As shown in FIG. 22, spout neck 38g terminates at an upper end thereof with an upper annular sealing surface 93g. Cap 36g includes an upper portion 98 having a smaller inside diameter than that of inner wall 41g of spout neck 38g. The bottom edge of upper portion 98 forms a downward facing shoulder 102. Shoulder 102 and sealing surface 93g are dimensioned and configured to abut against one another when cap 36g is fully threaded onto fitment 32g in order to provide a resealable fluid-tight seal therebetween.

[081] Frangible membrane 63g is frangibly joined along its periphery to inner wall 41g adjacent the upper end of spout neck 38g, that is immediately adjacent upper annular sealing surface 93g, as shown in FIG. 22. As in the above embodiments, frangible membrane 63g is attached to spout neck 38g along a line of weakness 64g.

[082] As shown in FIG. 22, four frangible connectors 103 interconnect circular portion 91g of gripping ring 86g and respective portions of frangible membrane 63g.

Frangible connectors 103 are circumferentially spaced along circular portion 91g. Although the illustrated embodiment shows four frangible connectors, one should appreciate that one or more frangible connectors can be utilized in accordance with the present invention.

[083] Frangible connectors 103 provide additional structural integrity between gripping ring 86g and frangible membrane 63g. Such additional structural integrity is advantageous in this embodiment because, once cap 36g is removed from fitment 32g, spout neck 38g offers little protection from a user inadvertently twisting or pulling ring 86g and accidentally tearing a portion of line of weakness 64g.

[084] Gripping ring 86g is connected to frangible membrane 63g adjacent line of weakness 64g and extends, almost entirely, above the upper edge of spout neck 38g and, in particular, upper annular sealing surface 93g. Upper portion 98 of cap 63g forms a deep chamber in order to accommodate the higher profile of gripping ring 86g. Such configuration provides a gripping ring which is substantially unobstructed by the spout neck thereby facilitating a user in grasping and pulling the gripping ring.

[085] The use and operation of fitments 32a-g, including the removal of frangible membranes 63a-g from spout necks 38a-g, respectively, are similar to that of fitment 32 discussed above. In particular, a user may grip and pull the gripping member to tear the frangible membrane from the spout neck to initially open the fitment and allow dispensing of the contents of the container to which the fitment is applied.

[086] In one embodiment shown in FIGS. 23-30, a modified fitment 32h includes a modified spout, a modified frangible membrane and a modified gripping ring in accordance with present invention. In many other respects, the structure of fitment 32h resembles that of the fitments discussed above.

[087] As shown in the figures 23-25, a tapered lower edge 104 of gripping member 69h is frangibly connected to an upper edge of spout neck 38h. In particular, frangible connection 107 interconnects the lower edge of circular segment 70h of gripping member 69h and the upper edge of spout neck 38h. Frangible connection 107 extends between first terminal end 71h and second terminal end 74h. In this embodiment, frangible connection 107 is in the form of an additional line of weakness which extends substantially along line of weakness 64h of frangible membrane 63h, as most clearly shown in Fig. 26.

[088] In the illustrated embodiment, circular segment 70h, as well as frangible connection 107, extends along a majority of the upper edge of spout neck 38h and adjacent line of weakness 64h. Preferably, circular segment 70h extends along the upper edge of spout neck 38h at least approximately 270 degrees, and in the illustrated embodiment, nearly the entire circumference of spout neck 38h. For reasons that will become apparent below, frangible connection 107 extends along the upper edge of spout neck 38h for a distance slightly less than that of circular segment 70h.

[089] Gripping member 69h is positively attached to frangible membrane 63h by a connecting web 108, most clearly seen in Fig. 27. Connecting web 108 is a reinforced structure, the thickness of which is substantially the same as the wall thickness of frangible membrane 63h and the wall thickness of spout neck 38h. The structure of connecting web 108 shown in Fig. 27 is much thicker than the thickness of frangible connection 107 shown in Fig. 26.

[090] Spout neck 38h further includes a stop 109 located in the frangible connection adjacent connecting web 108, as most clearly shown in Fig. 28. The purpose of stop 109 is to prevent and/or prohibit propagation along frangible connection 107 into connecting web 108. In the illustrated embodiment, stop 109 is an aperture located in frangible connection 107 immediately adjacent connecting web 108. One should appreciate that other forms of stops can be utilized in

accordance with present invention. For example, instead of an aperture, the stop may take the form of a protrusion or other type of increased wall thickness dimensioned and configured to prevent propagation along the frangible connection into the connecting web. Alternatively, one should appreciate that if the connecting web sufficiently bulky or thick, such connecting web may be sufficient to prevent propagation along the frangible connection into the connecting web without the need for a stop.

[091] In the illustrated embodiment, additional cap-engaging structure in the form of an additional external cap-engaging thread 113 is provided on an outer wall of circular segment 70h of gripping member 69h. Additional thread 113 is dimensioned and configured to cooperate with internal threads 49h of cap 36h, as most clearly shown in Fig. 29.

[092] In operation and use, a consumer will sometimes remove cap 36h from fitment 32h and verify that frangible membrane is intact in order to ensure that the contents of a container, to which closure 30h has been attached, have not been tampered with. The initial position of cap 36h with respect to fitment 32h is shown in FIG. 29. In order to initially open a container to which closure 30h is attached, the user will again remove cap 36h from fitment 32h thereby exposing gripping member 69h. The user grips second terminal end 74h of gripping member 69h in such a manner that the user can tear second terminal end 74h from spout neck 38h along frangible connection 107. The user continues to pull second terminal end 74h and to tear circular segment 70h along frangible connection 107 until stop aperture 109, together with the thickened connecting web 108, limits further propagation between gripping member 69h and the upper edge of spout neck 38h. The user's pulling force is then transferred to frangible membrane 63h along connecting web 108 such that the user can securely grip circular segment 70h firmly between his or her index finger and thumb and remove frangible membrane 63h from spout neck 38h. Once frangible membrane 63h is removed, the user may then partially or wholly dispense the contents of the container.

[093] In the event that a portion of the contents remains within the container to which closure 30*h* is attached, the user may then reseal the container by threading cap 36*h* back onto fitment 32*h*. Because gripping member 69*h* is no longer attached to spout neck 38*h*, the cap 36*h* can be screwed down further thus achieving a lower profile of closure 30*h* as shown in FIG. 30.

[094] For convenience in explanation and accurate definition in the appended claims, the terms “up” or “upper”, “down” or “lower”, “inside” and “outside” are used to describe features of the present invention with reference to the positions of such features as displayed in the figures.

[095] In many respects the modifications of the various figures resemble those of preceding modifications and the same reference numerals followed by subscripts *a*, *b*, *c*, *d*, *e*, *f*, *g* and *h* designate corresponding parts.

[096] The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.